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INFORMATION ON INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM -- SOVIET-BLOC ACTIVITIES

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I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

General Pokrovskiy Publishes Water Color Paintings of Future Space Technology

The famed Soviet space researcher, Professor Georgiy Iosifovich Pokrovskiy, Doctor of Technical Sciences and Major General in the Russian Armed Forces, is the author of an illustrated article in a recent issue of Sovetskiy Moryak (Soviet Sailor). The article is accompanied by a portrait of the author himself, his textual comments, and three drawings, two in full color, of future space vehicles and equipment.

"...It is well known," he states, "that the attempts of the Americans to overtake us in this most important field of science (space technology) have proven unsuccessful. Up to now they have not been able to develop a reliable intercontinental rocket ... and American rockets have been unable to carry into space such heavy payloads as are being sent aloft by the USSR."

"The time is coming when we will develop means for the braking of rockets during their entry into the atmosphere and methods will be developed for the safe landing of containers holding sensitive apparatus. The problem of the control of a manned rocket in space is becoming more and more urgent. No doubt about it -- Soviet rocket technology will soon be able to completely insure the sending of a man into space and his safe recovery -- and there are many eager volunteers for the first such trip into space."

"However, Soviet scientists for the time being regard the flight of a man into space as premature. This is because all the conditions of man's life in space have not been studied well enough to guarantee the protection of astronauts against various unexpected phenomena."

"The techniques of observation with modern instruments, television, for example, can yield far more data for scientific purposes than the impressions of a man sent to the Moon to see what is going on there. The impressions of a single individual can be subjective or insufficiently complete, whereas observations recorded on film can be studied, examined and debated by many scientists."

"Not only images, but sounds as well can be transmitted to the Earth. Special instruments will be capable of determining the degree of hardness of the Moon's surface and the surfaces of the other planets and even the chemical composition of the elements situated on their surfaces. All these results can be transmitted by radio to the Earth."

"There are also other methods of penetrating into space. For example, a jeep-mounted television transmitter can be moved anywhere on the Moon's surface and send back pictures to the Earth. This jeep and television transmitter can be operated by remote control from the Earth as easily as by a driver in the seat itself."

"There is no doubt that in the near future Man will fly into space, but even then many problems of space study will be solved with the assistance of television and remote control."

"In the series of drawings which I am presenting, I have tried to give a scientific-fantastic solution to the problem of automatic television transported to the Moon."

"The first picture shows the Moon-landing of an automatic space ship. Its jet motors are operating counter to the rocket's movement. This is to cut down the speed and insure a soft landing on the Moon's surface. The edge of the Sun can be seen behind the Moon's disk; it is surrounded by the Sun's corona. The part of the Earth turned toward the Sun is brightly illuminated. Because the Moon has no atmosphere, the stars and part of the Milky Way are clearly visible."

"The second water color gives an idea about the operation of an automatic 'space eye.' At the left, in the distance, amidst the Moon's landscape, we can see the container of the cosmic rocket. Leading to it is a deep trough made by the container on landing. In the center is an automatic undercarriage which has rolled from the container; after coming from the container the undercarriage unfolds and the balloon tires are automatically filled with gas. The two systems of thin-walled transparent 'bubbles' are the main part of the undercarriage. One is turned in the direction of the Sun. A curved mirror absorbs sunlight for a powerful solar battery. This is a solar electric station, furnishing power to the automatic undercarriage and its television apparatus. The second system of bubbles is turned earthward. It transmits the television image and other signals to earth. Such an apparatus, which could be called a 'cosmic eye,' is the same as having someone with human vision on the Moon or on some other body in space."

"The third picture shows a radiotelescope -- a receiver for the television images transmitted from the Moon and a transmitter of signals to the Moon for control of the automatic undercarriage. The mirror is part of a huge bubble made of very fine synthetic material. The highly sensitive apparatus, receiving, intensifying and recording radio transmissions from space, is housed in a massive structure which serves as the base for the radiotelescope." ("Invasion of the Cosmos," by Major General G. I. Pokrovskiy, Sovetskiy Moryak, No. 23, 1959, pp 10-11)

Masevich Comments on Methods of Satellite and Rocket Observations

An article appearing in Sovetskiy Flot of 23 January 1960 contains four paragraphs of generalizations about recent Soviet space accomplishments before adding specific details. The following text contains the highlights of this article whose author is A. Masevich, Doctor of Physical-Mathematical Sciences and Deputy Chairman of the Astronomical Council of the Academy of Sciences of the USSR.

The main subject of this article is the optical observation of the motion of artificial earth satellites, the processing of these observations, and the subsequent prediction of their future motion. With the passage of time, due to braking of the satellite in the upper layers of the atmosphere, the form and dimensions of its orbit gradually change. These changes can provide interesting data on the structure of the density of the atmosphere at various heights.

A special network of observation stations was established in accordance with the IGY program for the optical observations of satellites. At these stations visual observations are now being made with wide-angle astronomical telescopes.

On 1 January 1960 the USSR computing center had received data on more than 70,000 observations of the three Soviet satellites, including 30,000 observations from 35 foreign countries. Data has been received from many Soviet vessels at sea.

Visual observations play an important role during the last stage of the "life" of a satellite when it begins to enter the Earth's atmosphere. At this time its orbit changes so rapidly and irregularly that it is impossible to reliably predict it. At the same time observation of the entry of a satellite into the earth's atmosphere and its movement therein is of special interest because it enables us to study air density at different levels.

Sailors can be of great assistance to scientists at this stage. For example, the last days of the "life" of the rocket carrier of the third satellite and its fall were observed by the crews of Soviet and American ships on 29 and 30 November and 1 December 1958. These observations are of great value.

Experiments with the new powerful multi-stage Soviet ballistic missile have again required the assistance of sailors. These observations are being made aboard special ships of the Soviet fleet.

In photographing satellites astronomers have encountered still another new problem. Because the satellite moves across the heavens relatively rapidly, observations must be made with a telescope which has a special adaptation for the precise notation of time.

In the USSR the photographing of satellites is being conducted at 26 special stations with wide-angle aerosurvey cameras (the article is accompanied by a photograph of such a camera).

Still more precise coordinates for satellites can be derived if we attach special devices to large astronomical telescopes that insure a precise recording of the moment of exposure. The first such attachment was devised by D. A. Rozhkovskiy of the Astronomical Institute of the Academy of Sciences of the Kazakh SSR. At the Main Astronomical Observatory (Pulkovo) a camera with a moving film has been devised which enables us to record fainter satellites than those which it is possible to photograph by ordinary methods.

An interesting method has been devised by M. K. Abele, a scientist at the Riga station. The satellite was photographed through a telescope on a vibrating plate. This method enables us to photograph faint satellites. Photographs of Soviet satellites are also regularly received from abroad.

An important problem is the study of changes in the brightness of artificial satellites caused by their rotation and tumbling in space. V. P. Tsesevich, Corresponding Member of the Academy of Sciences of the Ukrainian SSR, developed a method for the determination of the period of rotation of a satellite around its axis by estimating its brightness as recorded at different stations.

The sodium cloud ejected by the second cosmic rocket was a new highlight in the investigation of space. This cloud was observed at many observatories and stations. Observations were made by means of specially developed dual cameras with different focal distances. The photographs were made through a special so-called interference filter that admits a very narrow band of light in the region of the yellow sodium line or through a yellow light filter. At observatories the sodium "comet" was also photographed by means of large astronomical telescopes. The sodium "comet" was also observed in Czechoslovakia, Scotland, France, England and Yugoslavia.

At the point on the Moon where our rocket landed, several observers in Budapest, L'vov, Khar'kov and in Sweden and England noted the appearance of a dark, and in some cases, of a bright spot on the background of the Moon. Observations were contradictory and their study did not lead to unanimous conclusions. Most likely what was observed was a dust cloud raised by the impact of the container against the surface of the Moon.

The advancement of Man into space, which was foreseen by the great Russian scientist K. E. Tsiolkovskiy, is occurring in our day at an unprecedented pace. The day is close at hand when the Moon itself will become a base for observation stations. Interplanetary travels are changing from fairy tales to reality. We note with pride that the science of the Soviet Union is playing the leading role in this invasion of space. ("Space Is Becoming Closer," by A. Masevich, Sovetskiy Flot, 23 January 1960, p 3)

Soviets Claim Two-Way Radio Contact Maintained During Rocket Re-Entry

This full page article is based largely on the proceedings of the UN Space Research Committee (COSPAR), especially on the report to that committee by Academician Blagonravov. Earlier in the article the following statement is attributed to Professor Konstantinov, director of the Technical Physics Institute of the Academy of Sciences of the Soviet Union (Szovjetunio Tudomanyos Akademiaja muszaki fizikai intezete), the source of the quotation is not fixed by date or previous publication: "It was possible to maintain two-way radio contact with the giant rocket [in the Pacific Ocean tests] throughout its entire flight. Accordingly, the rocket received and executed commands sent from Earth and measurement results came in complete form from the rocket to the Earth stations. But even more interesting -- and this is entirely new -- two-way contact was maintained during the re-entry phase while passing through the denser layers of the atmosphere." The article emphasizes the importance of the effectiveness of the heat insulation of the nose cone both for protection of explosive heads and for retrieving sputniks. N. Varvarov, "a well known pioneer of Soviet rocket technology," is cited as saying that the January rocket experiments proved the usefulness of oceanic tracking stations. ("Recent Achievements of Soviet Space Research," by Erno Nagy, Budapest, Nepszabadsag, 8 March 1960, p 9)

Artificial Planet No. 1 Nears Earth

The first artificial planet, officially designated as Artificial Planet No. 1, which was built and launched by the Soviet Union, will complete its first revolution around the Sun in the first part of April. According to V. Arsent'yev, scientific associate of the State Astronomical Institute imeni P. K. Shternberg, the first Soviet cosmic rocket will be approximately 200,000,000 kilometers away from the Earth. ("Astronomical Phenomena in 1960," by V. Arsent'yev, Sovetskiy Flot, 12 March 1960, p 4)

II. METEOROLOGY

Further Reports on the Weather Ship "A. I. Voyeykov"

The following is the full text of an August 1959 report on the "A. I. Voyeykov." It was written before the vessel put to sea.

The scientific research fleet of the Soviet Union has been supplemented by still another remarkable vessel. The Order of Lenin shipbuilders of the I. I. Nosenko works have built a first-class expeditionary vessel, the "A. I. Voyeykov," for the Main Administration of the Hydrometeorological Service of the USSR. It has been given that name in honor of one of the greatest Russian climatologists, geographers, and travelers -- Aleksandr Ivanovich Voyeykov.

The "A. I. Voyeykov" is a double-decked diesel powered vessel with elongated superstructure. It displaces 3,600 tons and has a speed up to 13 knots. The fuel and water supplies it carries enables the new vessel to remain in the most remote parts of the ocean for several months. The expeditionary ship is equipped with modern electro- and radionavigation equipment insuring trustworthy computation and determination of location when the shore is not in sight and under any conditions.

In essence the "A. I. Voyeykov" is a real floating scientific research meteorological institute. The vessel has hydrological, meteorological, aerological, synoptic and other laboratories.

With the introduction of the new research vessel it is becoming possible to study better the hydrological and meteorological processes prevailing on the high seas. Several remote control stations on shipboard automatically tape record the temperature of the water and air, air pressure and humidity, and wind force and velocity.

The free atmosphere regime, whose investigation is necessary for the determination of the laws of movement of air masses, will be studied by means of the systematic release of radiosondes. Special devices have been installed on shipboard to facilitate the release of radiosondes during any weather. Radar stations make it possible to observe their movement aloft.

The meteorologists have sets not only for the reception of coded meteorological data, but also for the reception of finished synoptic maps from various radiometeorological centers. The specialists on shipboard will compile weather forecasts by using these data.

Important work on the study of the waters of the oceans and seas will be accomplished by participants of the expedition aboard the "A. I. Voyeykov." Workers of the State Oceanographic Institute and the Institute of Hydrometeorological Instruments have developed new instruments for this purpose. One of them is a recording wavemeter. It makes it possible to continually determine the principal elements of waves as the ship moves on its course. An electromagnetic current measurer enables the workers to get information on the movement of water masses.

In the very near future the new scientific research vessel "A. I. Voyeykov" will depart on its first expedition. The floating institute will travel from Odessa to Vladivostok. During the time of this cruise the scientists will make varied investigations on the two oceans and many seas.

Participating on the expedition will be workers of the State Oceanographic Institute, the Main Geophysical Observatory, the Central Aerological Observatory, the Far Eastern Hydrometeorological Institute and the Institute of Applied Geophysics of the Academy of Sciences of the USSR.

During the voyage complex investigations will be made of the hydrological conditions of the monsoon zone of the Indian and Pacific oceans and the interaction of water and air masses in those regions.

The crew of the new research vessel is made up of highly trained seamen. The "A. I. Voyeykov" is commanded by the experienced Far Eastern captain N. F. Buyanov. The expedition is headed by G. S. Ivanov, Candidate in Technical Sciences.

The following is a summary of a feature article in the same publication; it was authored by A. Muromtsev, Candidate in Geographical Sciences, Deputy Chief of the expedition:

In September the "A. I. Voyeykov," under the command of Captain N. F. Buyanov, set sail from Odessa for Vladivostok. Scientific observations began at once, including echo soundings.

Because the oceans play an important role in the formation of climate and weather on the globe, the principal mission of our expedition was the study of the interaction of the ocean and atmosphere, water masses and dry land.

Aboard the vessel we used facsimile equipment and thereby immediately received by radio weather maps of immense areas of the Earth. Important typhoon observations were made; our stay in the western part of the Pacific Ocean coincided with their period of maximum development. During September and October several regions of the South China Sea gave rise to several very severe typhoons each week. The "A. I. Voyeykov" was successful in evading all the typhoons, mostly due to the precise predictions made by specialists aboard.

Our investigations in the Red Sea were of exceptional interest. We rather fully examined its vertical structure, its thermal conditions, and its salinity. Our observations showed that the value for evaporation in the Red Sea amounts to almost 16 mm per day. This is caused by the exceptionally high salinity and density of the water in that sea.

Subsequent hydrological research in the northern part of the Indian Ocean enabled us to trace the distribution there of the deep, highly saline waters of the Red Sea that have made their way through the Straits of Bab-el-Mandeb. In the Red Sea and Indian Ocean we discovered thick layers with a low oxygen content. For example, in the Arabian Sea the oxygen content had already decreased sharply at a depth of 50 meters. The upwelling of such waters to the surface is evidently the cause for the periodic mass starvation of fish.

Interesting observations were made of water exchange between the Arabian Sea, the Bay of Bengal and the Indian Ocean. In the period of our observations in the northern part of the Indian Ocean current measurements enabled us to establish the dominance of instable currents caused by the alternation of the monsoon. Our specialists discovered that electromagnetic current measurers could be used in the vicinity of the so-called magnetic equator.

After almost 13 days of sailing without sight of land the ship arrived in Singapore where it remained for four days. This was the only port visited during the voyage; many points of interest in the city were visited.

The ship then proceeded to the Pacific Ocean where it chanced to encounter the Soviet oceanographic research vessel "Vityaz," enroute to the Indian Ocean, near the island of Mindanao. The "A. I. Voyeykov" was visited on this occasion by V. G. Bogorov, Corresponding Member of the Academy of Sciences of the USSR, and the ship's captain, I. V. Sergeyev. ("The 'A. I. Voyeykov' Goes to Sea," by Commander S. Osokin, Sovetskiy Flot, 22 August 1959, p 4; and "The First Scientific Cruise of the 'A. I. Voyeykov,'" by A. Muromtsev, Sovetskiy Flot, 8 December 1959, p 4)

New Report on Interlatitudinal Heat Exchange in the Northern Hemisphere

The principal source of the kinetic energy of atmospheric movements is the potential energy of the nonhomogeneous temperature field, caused by the uneven influx of solar radiation to the Earth's surface.

The study of macroturbulence is important in the investigation of interlatitudinal heat exchange and for the general investigation of air movement which are important factors in the formation of the general circulation of the atmosphere.

G. V. Gruza, in a well-illustrated (12 diagrams) article, has analyzed the mechanism of macroturbulent heat exchange in the Northern Hemisphere for the two years 1953 and 1956 by using daily maps of the absolute topography of the 700 mb level and relative topography, using a grid for computations that contains 36 points on each latitude from 30° N to 80° N. ("Interlatitudinal Heat Exchange in the Northern Hemisphere," by G. V. Gruza, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, pp 341-345)

The Role of Turbulence in the Radiation Cooling of Clouds

This article, by Ye. M. Feygel'son, analyses the influence of turbulent mixing in a cloud on the effect of radiation cooling. It explains that the turbulent transfer of heat (when the coefficient of mixing is constant) leads to a substantial decrease in the cooling of the upper part of the cloud and to an increase in the thickness of the cooled layer. The article gives considerable quantitative examples of these processes. ("The Role of Turbulence in the Process of Radiation Cooling of Clouds," by Ye. M. Feygel'son, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No. 2, 1960, pp 299-308)

New Meteorological Station

The first radio transmission was recently made by the new high-mountain hydrometeorological station "Lednik Severtsova." The station was built by the Administration of the Hydrometeorological Service of the republic in the mountains of the Gissarskiy Range. The station is at a height of 3,500 meters above sea level. ("Latest News," Moscow, Izvestiya, 31 March 1960, p 2)

III. GEOMAGNETISM

Full Text of Recent Study of the Earth's Geomagnetic Field

The following is the full translation of an Academy of Sciences report. Comprehension of the report requires consultation of the original source, listed below, for the illustrations and graphs which are not reproduced here.

The generally used methods for investigation of variations of the Earth's electromagnetic field are based on a study of the periods and amplitudes of different kinds of variations. However, the electromagnetic field has vector characteristics, and investigation not only of amplitudes but also of these vector characteristics of the field provide us with supplementary data for understanding the laws of disturbances and the origin of KPK in the Earth's electromagnetic field and their connection with other geophysical and heliophysical phenomena.

This work examines only the spatial behavior of the variation vector, without consideration of the absolute amplitudes and phases of variations of different periods. In connection with the very complex picture of the behavior of the variation vector in space the article examines the behavior of the variation vector of the horizontal component of the geomagnetic field. Investigation of the behavior of the variation vector in vertical planes and the behavior of the full variation vector requires analysis by a special method and was not accomplished in this study.

The full vector of KPK of the geomagnetic field is being observed at the geophysical station "Borok" of the Institute of Physics of the Earth of the Academy of Sciences of the USSR (58°02' N, 38°58' E) by means of a so-called three-component apparatus. Basically it does not differ from the induction fluxmeter apparatus operating since the beginning of the IGY. It differs in that the three-component apparatus simultaneously records the variations of the components H_x, H_y and Z of the geomagnetic field.

The vertical component is recorded by means of a ground-embedded ring loop -- total area 15,700 m^2. The sensitivity of the channel Z to changes in the field is $1.4 \cdot 10^{-2}$ γ/mm.

The horizontal components are recorded by means of vertical rings situated on the northern and western walls of the magnetic pavilion (Figure 1).

One of the rings, with a total area of 6,834 m^2, is situated in the plane of the magnetic meridian and records the latitudinal (H_y) component of variations with a sensitivity of 0.502 γ/mm. The second

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ring is situated in a plane perpendicular to the magnetic meridian and has a total area of 6,303 m^2. This ring records the meridional component (H_x) of variations with a sensitivity of 0.53 γ/mm.

The recording of variations of all three components is accomplished on a single tape with the paper moving at 90 mm/hour. The width of the paper (200 mm) permits the recording of KPK even at the time of relatively disturbed periods. Examples of such records are given in Figure 2.

The fluxmeters used for recording have practically identical frequency characteristics and make it possible to record, free of distortion, variations with periods between 10 seconds and 2 minutes. Variations with greater periods are distorted depending on the period, identically on all three channels of the recording. Therefore the direction of the variation vector and the direction of its rotation, determined from the recordings, correspond to reality. For an analysis of the amplitude and phase characteristics of variations of different periods it is necessary to introduce amplitude and phase corrections.

In this study use was made of data based on processing of recordings of September 1958. During processing from the records of each hour of the day we selected the variations most clearly distinguished in the hourly period, that is, with the maximum amplitudes for variations in the selected period. In connection with the fact that the velocity for movement of the paper, 90 mm/hour, does not make it possible to read the values for amplitude more often than every 20 seconds, the vector diagrams were drawn for relatively long-period variations (periods between 2 and 10 minutes).

For the drawing of diagrams of the behavior of the variation vector of the horizontal component (hereafter we will simply refer to it as the "vector") we read the amplitudes of the recordings of the components H_x and H_y at one and the same moment of time from an arbitrary zero line.

Because the fluxmeter induction apparatus records the relative changes in the field, the position of the zero line for reading of amplitudes is inconsequential. The form of the curve described by the end of the variation vector and the direction of movement of the end point of the vector do not vary from the movement of the zero line parallel to itself. In the case of the drift of the fluxmeter zero noted on the recording (due to change of temperature or humidity), the zero line for reading of amplitudes is drawn parallel to the mean line of recording for consideration of drift.

Plotted on the graph are the positions of the end point of the vector at a given moment of time, determined by the vector sum of amplitudes of components. Generally accepted polarity was used when drawing the graphs (Figure 3).

For a clarification of the laws of behavior of the vector we selected characteristic indices of its behavior and examined their change during the course of the day.

1. In all cases the end point of the vector moves along a more or less complex curve, in many cases ellipsoidal, sometimes almost circular, and still more rarely -- merely skips along in a single direction. Since in an overwhelming majority of cases the curve has an elongated form with a clearly expressed direction for its greater axis, we took as a characteristic the magnetic azimuth of the greater axis of the elongated figure. The most frequent azimuth for the greater axis was from northwest to southeast. In 346 cases the greater axis was oriented from northwest to southeast, in 35 cases -- from northeast to southwest, in 8 cases -- east-west, and in only 42 cases out of 456 was the curve isometric.

The number of cases of the manifestation of one azimuth or the other of the greater axis varies. The azimuth has a clearly expressed prevailing direction. The northwest-southeast azimuth is most commonly encountered between 30°-40°. The mean azimuth is 38° W. A northeast-southwest azimuth is encountered in a total of 8% of the cases of observation and is evidently not characteristic of Borok (Figure 4).

The number of cases of manifestation of a northwest-southeast azimuth has a diurnal variation. The maximum in the diurnal variation is at midday, universal time (Figure 5, a). The number of cases of the manifestation of a northeast-southwest azimuth reveals practically no diurnal variation.

The manifestation of figures of isometric form, and also of figures of north-south and east-west orientations is quite regular during the course of the day. The greatest number of cases of manifestation occur in the morning (0400 hours) and in the evening (2000-2100 hours).

The maxima on this graph are symmetrically situated relative to the diurnal maximum of the diurnal variation of the number of cases of manifestation of an east-west azimuth (Figure 5, b).

The mean hourly values of east-west azimuths of the greater axis have a clear diurnal variation. At 0400-0500 hours the azimuth attains its maximum values (59° W), at 1500-1600 hours -- its minimum values (23° W). In the night and day hours the azimuth has intermediate values, changing smoothly from hour to hour (Figure 5, c). The diurnal variation of the azimuth of the prevailing direction of the variation vector of the horizontal component of the geomagnetic field coincides well with the diurnal variation of the azimuth of the prevailing direction of the variation vector of earth currents (Figure 5, d). The variation vector of the horizontal component of the geomagnetic field is oriented perpendicular to the variation vector of earth currents at all hours of the day, despite a clearly expressed diurnal variation of the azimuth of the prevailing direction in the case of both vectors. The mean hourly value of the azimuth of the prevailing direction of the variation vector was derived by O. M. Barsukov by means of a comparison of the maximum amplitudes of the meridional E_x and latitudinal E_y components of variations of earth currents. The mean value of E_x/E_y gives the mean value of the tangent of the angle between the prevailing direction of the variation vector of earth currents and the east-west direction.

Thus, the mean hourly value of the azimuth of the prevailing direction of the variation vector of the horizontal component of the geomagnetic field and the variation vector of earth currents, derived by various statistical methods, differ from one another by an angle of 90°.

The mean hourly values of the east-west azimuths of the greater axis of the diurnal variation were not discovered. This is additional evidence that easterly azimuths have a random character in the case of the behavior of the vector at Borok (Figure 5, e).

2. In a majority of cases the vector rotates. The prevailing direction of rotation of the vector is counterclockwise. Of 456 cases, in 258 the vector rotates counterclockwise, in 146 cases -- clockwise, and in only 52 cases it skips along in a single direction, with variable and complex deviations which cannot be regarded as rotational.

A clockwise rotation of the vector is observed primarily in the evening hours with a maximum number of cases at 1400-1500 hours. The clockwise rotation of the vector is rarely observed at night (Figure 5, f).

A counterclockwise rotation of the vector is most commonly observed in the morning hours with a maximum number of cases of manifestation at 0400 hours (Figure 5, g).

Cases of movement of the vector without rotation are rarely encountered and their distribution in the course of the day is of a random character (Figure 5, h).

In some cases additional curls are superposed on the basic circular motion of the end point of the vector. The direction of rotation in the supplementary curls sometimes coincides with the direction of the main motion, but it is sometimes directed toward it.

In connection with the fact that the variation vector, on rotating, changes its direction, we should check how the vectors of geomagnetic and geoelectric variations are oriented to one another at each given moment of time. To do this we drew vector diagrams of the variations of the horizontal component of the geomagnetic field and of earth currents during one and the same interval of time (Figures 6, 7).

The form of the curve, described by the end of the variation vector of the earth currents, is similar to the form of the curve described by the end of the variation vector of the horizontal component, considering the degree of accuracy of observations and graphical representations.

The direction of rotation of the vectors in each given case coincides.

However, if we examine the value and direction of change of the one vector or the other during intervals of time less than the period of variation, it is then apparent that the directions of change of the geomagnetic and geoelectric fields are almost perpendicular for each period of time. On the whole, however, one vector diagram is turned 90° relative to the other, and the direction of the greater axes of the figures formed by the ends of the variation vectors of the geomagnetic and geoelectric fields usually form a right angle. This perpendicular aspect is approximately maintained both for any interval of time and for any variation in the Earth's electromagnetic field. Deviations of the vectors from orthogonality are probably due to the horizontal anisotropy of the conductivity of the Earth's crust in the region of the station.

It is necessary, however, to check by more detailed investigation, with what degree of accuracy the perpendicularity of the vectors is maintained.

The coefficient of similarity of the vector diagrams or the ratio of amplitudes of variations in the geoelectric and geomagnetic fields does not remain constant. An attempt was made to find the dependence between the ratio of the amplitudes of variations in the geomagnetic and geoelectric fields and the period of variations.

As was noted earlier, by using the fluxmeter apparatus we can register variations with a period up to 2 minutes without amplitude distortions.

The earth current apparatus also records variations of 2 minutes and shorter without amplitude distortions. Therefore we compared the amplitudes of variations with periods between 10 seconds and 2 minutes.

From around-the-clock photorecordings of variations in the electromagnetic field we selected variations lying in the above-indicated range of periods and of an amplitude no less than 1 γ for recordings of the component H_x. Variations should be followed on the recordings for H_x, H_y, E_x and E_y. A graph was drawn of the relationship between the ratios

$$E_x/H_y,\ E_y/H_x \text{ and } E/H = \sqrt{E_x^2 + E_y^2} \,/\, \sqrt{H_x^2 + H_y^2}$$

and the period of variations.

The variations of the magnetic field were measured in gammas, the variations of the electrical field -- in mv/km.

As can be seen from Figure 8, the ratio of amplitudes of the variations of the electrical field to the amplitudes of variations of the magnetic field in essence depend on the period.

The ratio of the amplitudes E/H decreases sharply in the range of periods from 10 to 40 seconds, and then it holds almost constant, decreasing to an insignificant degree in the range of periods from 50 seconds to 2 minutes.

Thus, the selected characteristics of the behavior of the variation vector of the horizontal component of the geomagnetic and geoelectric fields (the shape of the curve formed by the end of the variation vector, the azimuth of the greater axis of such a curve and the direction of rotation of the variation vector) quite clearly characterize the behavior of the vector in time and in space.

The ratios of the directions and amplitudes of the geomagnetic and geoelectric fields are closely related. These ratios to a substantial degree depend on the geological peculiarities of the region where the station is situated. Such relationships require further study.

The simplest possible explanation for the development of horizontal variation vectors of the geomagnetic and geoelectric fields is the presence of electrical eddies in the ionosphere. Such eddies, on the order of several km in diameter, are broken down into vertical planes at heights of 100 km and more. They constitute fluctuations of the electrical charges which form the lines of force of the magnetic field, almost parallel to the Earth's surface, giving considerable values for the horizontal component of the magnetic field in comparison with the vertical component.

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The orientation of the curl and the direction of rotation of the projection of the axis of the curl on the Earth's surface have a clear dependence on the time of day.

There is no doubt that with further research on the laws of behavior of vector characteristics we will receive abundant data for an explanation of KPK and their relationship with other geophysical and heliophysical processes, and also new data for the development of geophysical methods of reconnaissance on the basis of the study of the natural geoelectric field. ("Some Results of Observations of the Variation Vector of the Horizontal Component of the Geomagnetic Field," by A. G. Kalashnikov and K. Yu. Zybin, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No. 2, 1960, pp 236-242)

IV. OCEANOGRAPHY

The "Sedov" Completes One Hundred Fifty Day Cruise in the Atlantic

The following is the substance of a recent report on the activities of the expeditionary vessel "Sedov":

The most remarkable of the oceanographic expeditions of the "Sedov" is the one just completed -- made in accordance with the International Geophysical Cooperation Program. It lasted 150 days, with the voyage partly in the Northern and partly in the Southern Hemispheres.

The carefully selected crew consisted mostly of old hands, but included a few thoroughly trained novices.

The vessel departed from Kronshtadt, sailed through the Baltic and checked out all gear and instruments before heading for Greenland, making oceanographic and meteorological investigations enroute. The voyage proceeded quite uneventfully, although radio communication was disrupted for several days in the middle of July. Academician V. Shuleykin, a participant on the expedition, explained that this was because the vessel was passing through an area where radiowaves were being absorbed by the great number of ions in the atmosphere.

Political lectures were scheduled daily.

It was necessary to operate on one of the engineers because of a stomach ulcer; the weather was brisk and the chief surgeon was suffering badly from seasickness, but the operation could not be postponed. The four-hour operation was successful.

The ship proceeded southward from Greenland. At the end of September the vessel arrived at the capital of the Republic of Guinea -- the city and port of Conakry; the ship and crew were enthusiastically welcomed. The "Sedov" was the third Soviet ship to visit the port of Conakry, and the first Soviet naval vessel to do so.

After taking on food and water, the "Sedov" set sail from Conakry and headed for the Southern Hemisphere, crossing the magnetic equator. The group under Academician Shuleykin began its work on approaching the area of maximum magnetic declination. The purpose of this work was the confirmation of Academician Shuleykin's hypothesis that magnetic declination changes with an increase in depth. For this investigation Academician Shuleykin designed and constructed a special apparatus which was lowered in a watertight container to given depths of the ocean where magnetic declination was to be recorded.

To all intents and purposes the hypothesis of the Soviet scientist was confirmed after two days of research.

The ship then sailed northward. A storm warning was received when the vessel was near the Azores, but it was already evident from the sky, wind and barometer that a storm was approaching. In the last half of the night the wind attained an intensity of 11-12, and the ship was in danger of the heavy seas over a four-day period.

At the end of 150 days the "Sedov" arrived in the Soviet port of Baltiysk. ("One Hundred Fifty Days in the Atlantic," by I. Toryanik, Sovetskiy Flot, 17 January 1960, p 4)

"Sovetskiy Flot" Confirms Previously Reported Soviet Bathysphere

The following brief article in "Sovetskiy Flot" appeared on 4 March 1960, with a dateline of Leningrad, 3 March 1960.

"The first Soviet deep-water research apparatus, a bathysphere capable of submerging to great ocean depths -- 11,500 meters, has been designed by the young Leningrad specialists M. Dnomidov and A. Dmitriyev."

"The apparatus consists of a metal cigar-shaped floater 17 meters long and 4 meters in diameter; to the bottom of the floater is attached a spherical chamber capable of holding two persons and scientific research apparatus. The walls of the sphere are made of an alloy steel 15 cm thick. During submergence the gasoline filling the floater is compressed by the water. This insures a slow and even submergence and equilibrium between inside and outside pressure to safeguard the apparatus from crushing."

"The bathysphere designed by the Leningrad specialists is a freely floating apparatus. It will be connected with its supply ship only by a telephone cable. Two small electric motors with propellors will enable it to move in the water at any given depth." ("Sovetskiy Batiskaf," Sovetskiy Flot, 4 March 1960, p 4)

The "Mikhail Lomonosov" Has Sailed from Riga for Atlantic Research Voyage

The following is a complete translation of a TASS report from Riga dated 12 January 1960:

The "Mikhail Lomonosov," expeditionary ship of the Academy of Sciences of the USSR, set sail today from its mooring place in the port of Riga on a new research voyage in the Atlantic Ocean. Before departure the following statement was made to a TASS correspondent by V. K. Agenorov, Candidate in Geographical Sciences, chief of the expedition:

"The new, seventh, cruise of the 'Mikhail Lomonosov' in the Atlantic Ocean will be made in accordance with the International Geophysical Cooperation Program. The expedition is made up of workers of the Marine Hydrophysical Institute of the Academy of Sciences of the USSR. Our research embraces the zones of the Antilles and Gulf Stream currents which are of dominating importance in the formation of the physical, physical-chemical and meteorological conditions of the North Atlantic."

"The research will be accomplished by using the latest automatic self-recording apparatus. The stations maintained over a period of some days are of great interest; these enable scientists to accomplish a complex of associated physical, physical-chemical, meteorological and aerological investigations in the hydrosphere and atmosphere." ("The 'Mikhail Lomonosov' Has Set Sail on Its Next Voyage," Sovetskiy Flot, 13 January 1960, p 4)

"Sovetskiy Flot" Pays Tribute to the Microbiological Studies of A. Ye. Kriss

G. Skryabin, Candidate in Biological Sciences and senior scientific associate at the Institute of Microbiology of the Academy of Sciences of the USSR, writes the following in a recent issue of Sovetskiy Flot. His remarks have been summarized.

The scientists of the Soviet Union are increasing their study of the tiny organisms populating the expanses of the world ocean, the laws governing their distribution and their adaptation to their environment. One of the most devoted and productive of these researchers is Professor Anatoliy Yevseyevich Kriss. He was the author of the world's first major study of marine microbiology "Marine Microbiology (Deep Water)"; this work has been proposed for consideration for the award of the Lenin Prize in science.

Kriss and other Soviet scientists have collected scientific data by travels on many seas -- from the Caspian to the waters of Antarctica, including the deepest trenches of the Pacific Ocean.

The Kriss book is unique in oceanographic and microbiological literature. It is the first such book to analyze the life of bacteria in practically the whole world ocean, from the surface to the ocean bed.

In his book A. Ye. Kriss devotes a great deal of attention to the microbiological processes of transformation of organic and inorganic compounds in the depths of the oceans. The author devotes a conspicuous place to a study of marine microorganisms capable of multiplying under a pressure of several hundred atmospheres; their existence may make possible an industry based on the biochemical activity of microorganisms.

The conclusions drawn by the author in his monograph go beyond the limits of "pure" microbiology -- they are of considerable importance for chemical and physical oceanography.

Bacteria play an important role in geological processes taking place in the layer near the bottom. They participate in the circulation of such elements as carbon, nitrogen, sulphur, iron, calcium, manganese and others. There is an accumulation of these elements in certain places as a result of their geochemical activity. It is impossible to understand the chemical processes taking place in the seas and oceans without a study of the activity of microorganisms. Kriss has convincingly demonstrated that microorganisms can serve as very sensitive indicators of the movement of water masses. For example, a number of deep currents have been detected and defined only by means of bacteria.

The position of layers with different densities has been graphically demonstrated with high accuracy by the microbiological method on the drift stations of the central Arctic and in the Indian, Pacific and Atlantic oceans on the "Ob,", "Vityaz" and "Lomonosov," It has been demonstrated that the hydrologic structure of the water masses is much more complex than has been assumed.

It is not only Soviet scientists who recognize the outstanding contribution of Kriss in the microbiological study of the world ocean -- it is also recognized by the principal foreign specialists in this field. To use the analogy used by a prominent French scientist, some of the data collected by Soviet researchers ... "is as sensational for the bacteriologists of the whole world as the news of the launching of the artificial satellites was for astrophysicists...."

The work of A. Ye. Kriss opens new horizons in the study of the unity of biological, chemical, geological and physical phenomena and the processes occurring in the ocean. ("Microbiology of the Ocean," by G. Skryabin, Sovetskiy Flot, 11 March 1960, p 3)

"Sovetskiy Flot" Runs Feature Article on L. A. Zenkevich

A feature article in the 11 December 1959 issue of Sovetskiy Flot deals briefly with the life and achievements of the outstanding Russian oceanographer Lev Aleksandrovich Zenkevich.

Zenkevich began to practice his profession even before the Great October Socialist Revolution. He graduated from Moscow University in 1916 and took part in expeditions to Lake Baykal and the Arctic Ocean, but it was during the years of Soviet rule that his scholarly efforts were most conspicuous. In 1921 he became one of the organizers of the world's first "marine institute afloat," and he participated on many voyages of the special expeditionary vessel "Persey." He not only was chief of several expeditions, but also headed all scientific work of the institute. Personally he concentrated on the study of the bottom fauna of the northern seas and published a number of valuable works on this subject.

For example, Zenkevich demonstrated that the food supply for fish in the Caspian was dropping sharply. He had noted that the Sea of Azov was especially productive in this respect and that its hydrological conditions were similar to those of the Northern Caspian. On the basis of many years of concentrated study and deep analysis of the organisms living in the Caspian, Zenkevich was able, in 1932, to offer a solution to this problem of declining food reserves for fish in the Caspian.

His concentrated application on the problem of enrichment of the fauna of the Caspian Sea did not prevent L. A. Zenkevich from conducting extensive research in other fields of zoology and oceanography. The scientist devoted many years of work to his two-volume study "Fauna and the Biological Productivity of the Sea," containing extensive factual material and important theoretical conclusions; for this work he was awarded the Litke gold medal of the Geographical Society of the USSR.

The Institute of Oceanology of the Academy of Sciences of the USSR was organized after the end of the Great Fatherland War, in January 1946. Over a period of several years Zenkevich headed complex expeditions aboard the "Vityaz," especially on the seas of the Far East. The group of scientists of which Zenkevich was a member was awarded the Stalin Prize in 1951.

The Kurile-Kamchatka trench was studied in detail with the active participation of L. A. Zenkevich; it was found to be 10,382 meters deep. Zenkevich was awarded the Lomonosov Prize for this research, and recently the French Oceanographic Institute awarded him the medal of Prince Albert I of Monaco.

This year Lev Aleksandrovich Zenkevich will be 70 years old, but he is still working a hard schedule and is filled with new and creative ideas. ("Investigator of the Sea," by Commander S. Osokin, Sovetskiy Flot, 11 December 1959, p 3)

A Radar Beacon for Use in Determining Marine Currents

Since the end of the last war new and effective methods have been used for the study of currents. Such methods include electromagnetic and radar-type devices. The first gives satisfactory results in deep-water basins, whereas the second is more effective in shallow waters. In the latter case a beacon with a passive reflector attached is observed by using radar equipment. This method, developed in the USSR in 1947, was, after refinements, successfully used in the Baltic Sea for a detailed survey of currents there. It has also been used extensively aboard our expeditionary vessel the "Vityaz."

A number of such beacons are lowered from the ship when the vessel is standing at anchor; their position on the sea is determined periodically by means of the ship's radar equipment. By plotting and connecting on a chart the observed positions of the beacons we can detect the directions in which they are moving -- under certain conditions these will correspond to the actual currents in the sea. Corner reflectors enable us to accomplish at one anchorage a survey of the surface currents over an area of about 80 square kilometers. It is not necessary that the ship remain at anchor, however, provided that one of the beacons is anchored.

Currents can also be measured by a radar station on the mainland. In this case beacons with reflectors are lowered into the water from an auxiliary cutter, with two-way radio connection between the boat and the shore station. An area of 100 square kilometers can be covered from one survey point.

Stormy weather is no obstacle to the making of observations and does not diminish their accuracy. Eight to ten beacons are lowered away in each series in a checkerboard fashion, at distances of 500 to 800 meters from one another. There is no doubt that in the future radar will be used more and more when studying currents in seas and oceans. ("Radar Beacon," by I. Nikitin, Sovetskiy Flot, 28 August 1959)

Soviets Devise New Apparatus for Wave Measurement

The following is the full text of an article appearing in Sovetskiy Flot dated 13 January 1960. The author is N. Vershinskiy, Candidate in Technical Sciences, Chief of the Laboratory of Marine Electronics, Institute of Oceanology of the Academy of Sciences of the USSR.

There is a calm at sea. It is as if nothing foretells of bad weather. But not a single ship leaves port. A warning signal has been hung on the signal mast; gale-force winds are expected! How did the port master get this information?

On the high seas, not far from the harbor, there is a special apparatus submerged at a depth of several dozen meters; this device records oscillations of the water. A cable leads from the apparatus to the shore where an oscillograph, for recording these oscillations, and another automatic instrument -- a harmonic analyzer, are housed in a closed building. The engineer on duty analyzes the oscillograms of the wave action several times each day. In making his last analysis he discovered the presence of forerunners of a gale -- so-called characteristic oscillations, very small oscillations of the water that precede bad weather. Their velocity of propagation in the water of the ocean is considerably greater than the velocity of movement of the storm front; it is therefore possible to get a warning of a storm several hours in advance.

At the present time many countries are giving great emphasis to the establishment of such wave-measuring stations. There is such a station, for example, in the Chinese People's Republic, at Tsingtao. This station on two occasions in recent times has issued timely warnings of severe storms on the basis of such data.

Storm-driven waves are a danger not only to ships at sea, but also to various structures on the shore or near it, and sometimes for the shoreline itself. Every year the national economy suffers immense losses due to erosion along the coast and the destruction of various kinds of buildings.

Interesting research on the study of wave action on the Caspian Sea has been carried on by the scientific workers Ya. G. Vilenskiy and V. Ye. Glukhovskiy, Candidates of Technical Sciences of the State Oceanographic Institute. By means of the data units that they developed, they have recorded valuable data concerning the wave regime. For example, they found that the height of the waves in the open part of the sea in several cases exceeded the height of those immediately along the coast by as much as 10 meters! This is a large figure for an inland sea such as the Caspian. The data collected will be taken into account when designing marine oil derricks.

A whole family of various electronic instruments for investigation of the dynamics of the coastal zone has been developed at the Marine Electronics Laboratory of the Institute of Oceanography of the Academy of Sciences of the USSR. Electrical wavegraphs for the recording of surface waves in the coastal zone have been developed at the laboratory; those enable us, to all intents and purposes, to record any amplitudes of waves in the range from several centimeters to ten meters. For precise laboratory measurements the laboratory associate V. P. Sokolov has developed an electrical wavegraph, recording surface waves by means of a capacity data unit. This instrument enables us to record wave amplitudes from fractions of a centimeter to a half meter. Another associate, A. P. Kestner, constructed a stringed wave graph for the recording of waves with a height up to three meters.

Special instruments have been developed at the Institute for the measurement of the force of wave impact against an obstacle. The scientists have now found it possible to simultaneously examine the entire process of wave impact against a rigid obstacle on the oscillograph. The staff of the hydrological station at Sochi has been able to formulate a series of new laws by using instruments of this type over a period of years for measurements under natural and laboratory conditions.

The detailed study of submarine wave action in the coastal zone became possible by means of a new "VDK" apparatus. Thus it has been discovered that in several cases there is substantial significance to the force associated with the so-called gradient of hydrodynamic pressure and caused by the presence of acceleration in the field of action of gravitational waves. It is possible that the severest cases of destruction of submarine breakwaters are associated with it.

The measurement of wave parameters on the high seas is considerably more complex.

Recently a scientific associate of the Eastern Siberian Branch of the Siberian Division of the Academy of Sciences of the USSR, A. K. Kuklin, developed an autonomous radiowavegraph. The new apparatus determines and transmits by radio the height, period and velocity of movement of waves and also determines and transmits wind velocity and the velocity and direction of drift of the wavegraph floater.

The national economy and the fleet most definitely require the continuing perfection of instruments for the investigation and prediction of various wave parameters. ("Apparatus Predicts Storms," by N. Varshinskiy, Sovetskiy Flot, 13 January 1960, p 4 -- a photograph accompanies the article: it illustrates the VDK apparatus referred to in the text)

New Article Reflects Soviet Research on Seasonal Changes in Ocean Currents.

This article, contained in the most recently received issue of the Izvestiya of the Academy of Sciences of the USSR, Geophysical Series, examines a simple theoretical pattern of seasonal changes of ocean currents, based on the hypothesis of the quasistationary nature of drift- and the quasigeostrophic nature of gradient components of the total current. Computations made on the basis of the derived formulas enable us to explain the characteristic peculiarities of the seasonal changes of such ocean currents as the coastal Java current in the Indian Ocean, using as a point of departure the peculiarities of the wind field and taking into account the substantial influence of the shore on the convergence and divergence of drift currents. ("Seasonal Changes in Ocean Currents," by K. N. Fedorov, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No. 2, 1960, pp 278-287)

V. SEISMOLOGY

"Izvestiya" Reports on Two Widely Separated Earthquakes

On 20 March at 2018 hours the Central Seismic Station of the Academy of Sciences of the USSR recorded a strong earthquake. The epicenter was situated 7,400 km from Moscow in the Pacific Ocean near the islands of Japan.

A correspondent of the Associated Press News Agency relayed from Tokyo to New York that the Central Meteorological Administration reported subterranean shocks in Northern Japan. A representative of the administration declared that the earthquake was felt most strongly in the vicinity of Aomori and Morioka. Its intensity there was estimated at four on the Japanese seven-unit scale. This means that buildings were shaken. The earthquake epicenter was situated in the Pacific Ocean approximately 350 miles northeast of Tokyo. The administration representative added that as might be expected, the earthquake was followed by a tidal wave which possibly struck in Northern Japan.

On 22 March the Central Seismic Station in Moscow again recorded a vibration of the earth's crust in this region, but of lesser intensity. There was another strong shock on 23 March.

On 20 March the station director, Professor Ye. F. Savarenskiy, had the following to say concerning this earthquake:

The amplitude of vibrations of the earth's crust in the vicinity of Moscow amounted to 850 microns. This corresponds to a shock having an epicentral intensity greater than 10 (on a 12-unit scale). It was a catastrophic earthquake. It was so strong that the so-called elastic vibrations of the earth's crust were noted by stations over a several hour period as the waves raced around the globe.

If the epicenter had not been situated in the ocean, but on the mainland, near cities and villages, the earthquake would have caused a major disaster. It would have destroyed homes and other structures and many people would have perished.

But an earthquake is frightful even at sea. It can cause a tsunami -- a tidal wave which breaks with tremendous force on the shores of islands and the closest part of the mainland.

After an intense earthquake individual shocks can be observed for an extensive period of time, gradually weakening and then dying out. The epicentral shock of 23 March was evidently of an intensity of 8-9.

During the night hours of 21 March still another earthquake was recorded, this time in Dagestan. Comrade Tabulevich, Director of the Makhachkala seismic station, reported that on that night at 0302 hours 48 seconds and 0307 hours 33 seconds the residents of Makhachkala and neighboring populated points felt subterranean shocks of an intensity of approximately 5-6. The earthquake epicenter was situated 20 km from the city in the vicinity of the Caspian Sea.

This was a moderate earthquake, local in nature. Comrade Tabulevich points out that shocks of this intensity will only cause the rattling of window panes, the falling of loose objects, and a limited amount of shifting of furniture. Small cracks in buildings may occur.

At 1945 hours on 25 March a new shock wave was recorded. Professor Savarenskiy surmised that the focus of this earthquake was situated at a shallow depth. ("Two Earthquakes," Izvestiya, 29 March 1960, p 4)

Automation at Seismic Stations of the Northern Tien Shan Zone

This article, by the late A. A. Fogel' of the Institute of Physics of the Earth, gives a description of equipment installed at seismic stations in the northern Tien Shan zone for the automatic improvement of incandescence, introduction of multi-stage sensitivity-reduction, and warning to station personnel at the time earthquakes are recorded.

These instruments, says Fogel', insure (a) a clear and readable record of earthquakes, including strong remote earthquakes of any intensity; (b) the warning of station personnel that an earthquake is being recorded and also about the burning out of collimator tubes, and (c) the semiautomatic reception of precise time signals on tape.

It is important to note that these instruments can be used at regional stations as well as at stations of a general type. The use of this equipment at the seismic stations of this zone will result in a substantial improvement in the quality of earthquake records. ("Automation at the Seismic Stations of the Northern Tien Shan Zone," by A. A. Fogel', Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No. 2, 1960, pp 229-235)

Multi-stage Sensitivity-Reduction in Seismographs

The article states that the following conclusions may be drawn in respect to sensitivity reduction in seismographs:

1) When there is multi-stage sensitivity-reduction it is feasible to activate sensitivity-reduction shunts successively in order that the coefficient of sensitivity-reduction increases following a geometric progression.

2) The 125X sensitivity-reduction used at the seismic stations of the Northern Tien Shan zone is not excessive.

3) For the satisfactory recording of earthquakes of different intensity at seismic stations there should be, in addition to multi-cascade sensitivity reduction of the main apparatus, low sensitivity instruments on which recording is made only during rather strong earthquakes.

4) When there are large-scale amplitude oscillations of the soil there are no noticeable spurious vibrations of the galvanometer frame to distort the recording. ("On the Possibility of Utilizing Multi-stage Sensitivity-Reduction of Seismographs," by V. M. Fremd, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No. 2, 1960, pp 323-325)

VI. ARCTIC AND ANTARCTIC

Members of the Fourth Soviet Antarctic Expedition Return to Russian Soil

The following is the full text of a TASS report of 29 March 1960, datelined Riga:

The diesel motorship Kooperatsiya arrived in Riga late yesterday afternoon. Aboard the vessel were more than 100 participants in the Fourth Soviet Antarctic Expedition, now returning to their Motherland.

The Chief of the Fourth Antarctic Expedition, A. G. Dralkin, Candidate of Geographical Sciences, reported to a TASS correspondent as follows:

"At the end of January 1959 the scientific detachments of our expedition, transported to Mirnyy aboard the diesel electric ship 'Ob' and the diesel motorship 'Mikhail Kalinin,' began research work on the Program of International Geophysical Cooperation. One of our most important objectives was the all-around investigation and exploration of the central and remote regions of the Antarctic by means of the organization and equipping of expeditions made up of sledge-tractor trains."

"On 27 September 1959 a sledge-tractor train departed from Mirnyy for the region of the South Pole. In a 98-day period the expedition traversed 6,300 km in the central and remote regions of Antarctica. They accomplished a great amount of work in general geography, meteorology, terrestrial magnetism, glaciology, seismic sounding and gravimetry."

"In October of last year the air detachment chartered a new air route 3,300 km long between Mirnyy and the newly established Soviet station 'Lazarev.' In 13 months the air detachment of the Fourth Expedition flew about 1,800 hours."

"The participants on the expedition collected a great amount of data on the nature of our planet's severest continent." ("New Route Chartered," Sovetskaya Aviatsiya, 30 March 1960, p 4)

Drift Station Personnel Flown In

Personnel for the new drift station, "Severnyy Polyus-9," were flown into the Arctic by an airplane of the polar aviation on 30 March. Replacements for members of the staff on drift station, "Severnyy

Polyus-8," were also aboard the plane. ("Latest News," Moscow, Izvestiya, 31 March 1960, p 3)

VII. GEOLOGY

Leningrad Group Uses Argon Method to Determine Age of Earth

Leningrad scientists under the leadership of Academician A. Polkanov have compiled a scale for calculating the absolute age in years of rock formations found in the Kola Peninsula, Karelia, Finland, Sweden, and Norway. They have established that the Earth is 4.5 billion years old. They were using the so-called Argon method. The method also offers new possibilities for conjecturing on the places of occurrence of iron, copper, nickel, and other minerals in the Pre-Cambrian geological period. ("How Old Is the Earth," (unsigned news item), Bratislava, Uj Szo, 10 March 1960, p 3)

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